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# COMPARISON OF FACE RECOGNITION QUALITY USING BLACK-AND-WHITE AND COLOR IMAGE

**Abstract:** Today facial recognition is an important element of ensuring security and preventing illegal acts. In order to popularize and widely disseminate this method of biometric identification the quality and accuracy of facial recognition should be improved. The purpose of this paper is to compare the efficiency, accuracy, and quality of facial recognition using color and black and white images. The comparison is made by conducting experiments with several people who pass the camera, which is set for recognizing faces. In the course of the experiments the features of their faces, the walking speed, the poses are changed each time. The recognition system also has a built-in function of age determination. Based on the results of the experiments, the effectiveness of this function is also analyzed using a color and black and white image. A small number of people for experiments, of course, does not allow to draw comprehensive theoretical conclusions, but conclusions based on the results of experimental data analysis provide an opportunity to argue the feasibility of using facial recognition as part of biometric identification systems in each particular case and reasonability of using this method in complexes where high degree of security is needed.

**Keywords:** face recognition, biometric identification, security systems.

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# СРАВНЕНИЕ КАЧЕСТВА РАСПОЗНАВАНИЯ ЛИЦ ПРИ ИСПОЛЬЗОВАНИИ ЧЕРНО-БЕЛОГО И ЦВЕТНОГО ИЗОБРАЖЕНИЯ

**Аннотация:** На сегодняшний день распознавание лиц является важным элементом обеспечения безопасности и предотвращения противоправных действий. Для популяризации и широкого распространения этого метода биометрической идентификации необходимо повышать качество и точность распознавания лиц. Цель этой статьи – сравнить эффективность, точность и качество распознавания лиц при использовании цветного и черно-белого изображения. Сравнение производится путем проведения экспериментов с несколькими людьми. Они проходят мимо камеры, которая установлена для распознавания лиц, каждый раз изменяя особенности своего лица, скорость прохода, позу и т.д. В систему распознавания так же встроена функция определения возраста. На основании результатов экспериментов производится анализ эффективности этой функции при использовании цветного и черно-белого изображения. Небольшая выборка людей для опытов, конечно, не позволит сделать исчерпывающих теоретических заключений, но в результате анализа экспериментальных данных сделаны выводы, на основании которых можно судить об целесообразности применения распознавания лиц в составе систем биометрической идентификации в каждом конкретном случае и допустимости применения этого метода в комплексах, где необходима высокая степень безопасности.

**Ключевые слова:** распознавание лиц, биометрическая идентификация, системы безопасности.

The problem of quality of face recognition is very important today. This method of biometric identification has been actively developed recently. We should clearly understand whether we can completely trust this method or not. Popular and cheap face recognition systems can identify a face only when the human is watching right to the camera. Therefore, we cannot use it for hidden identification (except for expensive professional systems). For face recognition system to be used as part of access control systems, first it should be fast, because it should not instigate queues and delays. The question why accuracy is not the main characteristic can arise in this case. Of course, it is one of the main characteristics, but face recognition systems are used most often along with other methods of identification which support it with accuracy of identification. We can choose an affiliate method using information from the article «Comparison of Biometric Identification Methods» by Csaba Otti [1]. Consequently, we can define two main parts of quality of face recognition. First of all, it is the speed of recognition and secondly, it is accuracy of identification.

**Equipment**

To conduct the experiments the following equipment was chosen: a camera LTV CNE-631 4G which has 1/2.8 CMOS matrix, 3 Megapixels resolution and motorized zoom lens with focal length 9-22 mm, and INTELLECT software package ver. 4.10.4 with add-on Face-Intellect ver. 7.1. For recognition module we used Tevian recognition module. This module analyzes the most distinct anthropometric points in the face. It finds their localization in the on-line video stream and compares with samples from the database. As a video server we used the laptop with the following features – CPU: Intel Core i5 7200, GPU: NVidia GTX 640m, RAM: 4 Gbytes.

**Experiments and methodology**

The participants of the experiments are represented by five men and one woman. One of the men wears glasses, and another has a beard. The camera is installed at a distance of 2.5 meters from the doorway. In the software, the following parameters are set: recognition distance, proportions of faces on the image, range of sizes of faces in pixels, minimum quality of faces for the recognition process (in percentile). Settings are set for the specific case. They are selected individually, depending on the resolution of the video stream, the size of the doorway, the distance from the camera to the recognition point, the camera installation angle and other local parameters. We select 70% for the quality

of faces. Previously, the faces of all the participants with their usual facial expressions have been uploaded into the database.

Firstly, we select a color image. All of the participants pass the camera with their usual facial expressions. We get about 75-80% matches with the samples from the database. After that, the participant who was initially wearing glasses passes the camera without the glasses (usually he wears glasses and on the sample he is depicted with glasses). The system cannot determine the person, since we have about 50% matches with the sample. We assume, that it could be caused by the reflection of light in the glasses and a poor image of the eyes. The other participant passes the camera twice wearing a hat. We have about 70% matches. In one of the passes we have an interesting case. By mistake the system recognizes the man as a woman.

Then, we select a black-and-white image of video stream. We repeat the experiment. We observe an increase of accuracy in the recognition process for about 10-20% (see Figure 1).

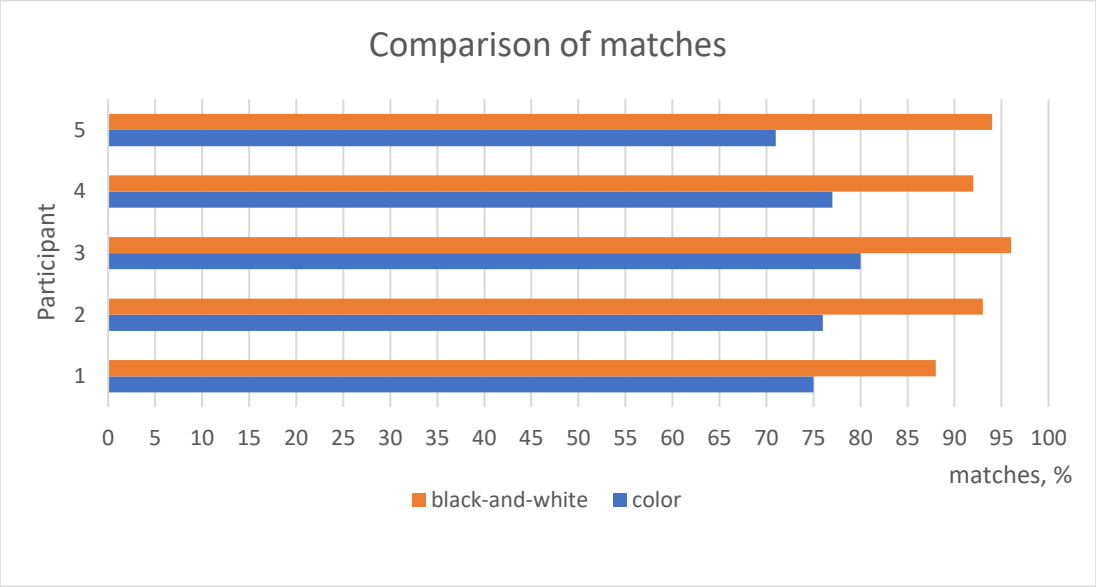


Figure 1 – Diagram of comparison of matches

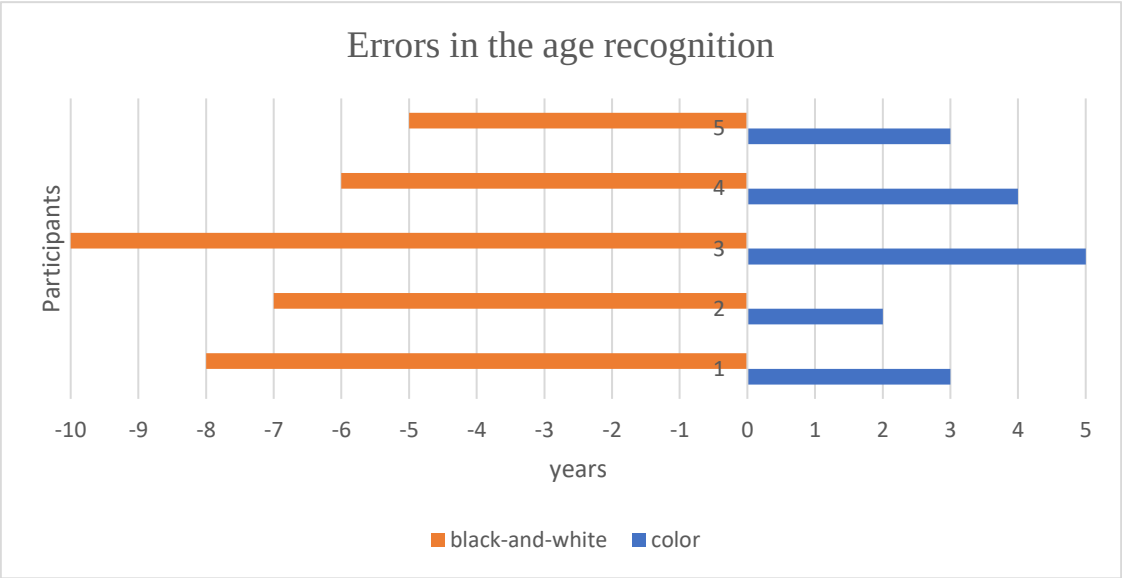


Figure 2 – Comparison of errors in the age recognition

The age recognition function identifies the age of the participants and gives inaccurate results. The error is about 5 years. If a participant has a beard, the system shows that his age is more than it actually is. If a participant has little wrinkles, the system shows that his age is less than it actually is. When we select black-and-white image of video stream, the system recognizes the age incorrectly. The error is about 7-10 years. (see Figure 2). As a result, it should be noted that if we want to recognize the age of a person we shouldn't use black-and-white image.

Thus, this paper compares the quality of face recognition using color and black-and-white images. The choice between the two types of images depends on the aims we pursue. If we need a system which should quickly and accurately recognize a face, but the age recognition is not important for us, the best way is to choose a black-and-white image of video stream for the recognition system. If the age recognition is of high value for us, we should use a color image.

## REFERENCES

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